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ABSTRACT

This paper discusses an innovative paradigm for looking at computer mediated/networked teaching, learning, and research known as BESTNET (Binational English and Spanish Telecommunications Network). BESTNET is functionally defined as an international community of universities and institutions linked by common educational goals and processes, computers, and telecommunications. BESTNET is conceptually designed as a virtual integrated educational system for learning and teaching across geographic spaces, i.e., from one campus to another, nationally/globally. Currently, the project involves over 7,000 culturally and linguistically diverse groups of students from over a dozen institutions in the United States, Mexico, and other globally specific regions. Following an overview and description of the BESTNET design, the paper discusses the growing need for multimedia computer global network communications, related developments with translation technologies, and the adaptive infrastructure of BESTNET. (AEF)

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Latino Studies Series

Viable Global Networked Learning

by Armando A. Arias, Jr., Ph.D.
California State University, Monterey Bay

Occasional Paper No. 23
January 1997

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Viable Global Networked Learning

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Occasional Paper No. 23
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Overview

This article discusses one of the most innovative "paradigms" for looking at computer mediated/networked teaching, learning and research known as **BESTNET** (Binational English and Spanish Telecommunications Network). **BESTNET** is functionally defined as an international community of universities and institutions linked by common educational goals and processes computers and telecommunications. **BESTNET** is conceptually designed as a "virtual" integrated educational system, designed for learning and teaching across geographic spaces, i.e. from one campus to another (nationally/globally).

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Viable Global Networked Learning

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JSRI Occasional Papers: for the dissemination of speeches and papers of value to the Latino community which are not necessarily based on a research project. Examples include historical accounts of people or events, "oral histories," motivational talks, poetry, speeches, and related presentations.

The **Julian Samora Research Institute** is committed to the generation, transmission, and application of knowledge to serve the needs of Latino communities in the Midwest. To this end, it has organized a number of publication initiatives to facilitate the timely dissemination of current research and information relevant to Latinos.

- *Research Reports:* **JSRI**'s flagship publications for scholars who want a quality publication with more detail than usually allowed in mainstream journals. These are edited and reviewed in-house. Research Reports are selected for their significant contribution to the knowledge base of Latinos.

- *Working Papers:* for scholars who want to share their preliminary findings and obtain feedback from others in Latino studies. Some editing provided by **JSRI**.

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- *Occasional Papers:* for the dissemination of speeches and papers of value to the Latino community which are not necessarily based on a research project. Examples include historical accounts of people or events, "oral histories," motivational talks, poetry, speeches, and related presentations.

Viable Global Networked Learning

by Armando A. Arias, Jr., Ph.D.

Overview

BESTNET was established in the early 1980's, as an effort to link universities on both sides of the U.S.-Mexico border through microwave, satellite and cable television technologies. In the late 1980's **BESTNET** focused primarily on the development of asynchronous computer mediated learning and teaching in an internationally networked virtual environment. For the past six years (1990's) **BESTNET** has strengthened its binational ties and continued its "high tech" focus through the development of active or vibrant model technology which is assisting in the creation of an on-line binational university setting that is "borderless" (albeit, seamless to the user). Today, this type of design and linkage for curriculum, learning, teaching, research and performing collaborative scholarly work is called a "global virtual university."

The design center for **BESTNET** is the vibrant global model based on METIS software. While the binational (U.S.-Mexico) design of **BESTNET** continues to flourish, new technologies are being continually assimilated into this highly adaptive project. Specifically, as we are able to combine the interests of a multitude of globally located campuses. We are also working towards a virtual project for higher education. Our operating, developmental premise has always been to redefine faculty, staff and student roles towards this purpose.

BESTNET was created with the assistance of the founder of ARPANET a direct precursor to the Internet (even before the Internet was popularized) as a scholar's collaborative network, with the explicit charge of exploring alternative approaches to the structures, substance, and processes which have traditionally defined the scholarly work of institutions of higher education. We have continually demonstrated courage in tackling difficult, but essential, issues of "technological renewal." We are committed to developing educational programs which are especially responsive to both regional and global needs, student-centered, interdisciplinary in scope, and technologically innovative in nature.

The tremendous success of the **BESTNET** paradigm is that we are not only "renewing," we are also "brandnewing" an ambitious global and virtua educational model that will yield improved educational outcomes (in both low- and high-tech) setings, within the financial resources of most academicinstitutions. We have especially developed positive outcomes in Africa, Latin America, the United States and Europe. Because we barter and share colledively our on line resources, we avoid the exchange of funds, academic credits and the multitude of bureaucracies that are associated with traditional institutional exchanges. In short, we create a virtual learning environment for the "world" evolving student to experience like never before. While other projects are undergoing transformation from the Industrial Age to the Information Age, **BESTNET** is successfully aligning to the global needs of the Cyber-Age, by design.

Design of a Global Virtual Culture of Innovation

BESTNET has greatly impacted postsecondary education, especially along the U.S.-Mexico border (Arias & Bellman, 1992; 1994; and 1995). It has provided new opportunities to reach students currently under-represented in the fields of science, engineering, computer information, teledramatic arts, the social and behavioral sciences, and technology, and has enhanced career opportunities by providing access to new technologies, virtual learning experiences, and academic disciplines (Arias & Bellman, 1995). The U.S.-Mexico project was initially funded by three separate grants (for nearly $1 million) from one of the most innovative divisions of the U.S. Department of Education or FIPSE (Fund for the Improvement of Post Secondary Education). **BESTNET** subsequently received over $2 million in several additional grants from the Digital Equipment Corporation, as well as the Western Behavioral Sciences Institute to improve the technical, learning, teaching and research capabilities of the network. "**BESTNET**ers" possess a shared commitment to effectively assisting all students, particularly historically under-educated and low-income populations, to develop the technological capacity to apply a broad range of knowledge and skills acquired from multiple

sources to the resolution of complex, real-life problems; whether it be solving drip irrigation in Northern Africa or learning calculus in a bilingual mode. As an "institution" **BESTNET** supports technological actions aimed at redesigning educational environments for the purposes of improving education. We have "designed-in" viability, we apply on line technological global usage's, where others have remained on the "desk-top," we are taking notions educators dream about, and, actually implementing them — globally.

BESTNET has quickly expanded to include a number of universities in the Southwest border region in concert with several technological institutes and universities in Mexico. Over the past 13 years, we have organized a number of globally arranged campus and off-campus learning centers to deliver courses using the **BESTNET** network as global testbed groups to evaluate and continually improve its technical and pedagogical features (Arias, 1992). The project now involves over 7,000 culturally and linguistically diverse groups of students from over a dozen institutions in the United States, Mexico and other globally specific regions (Arias & Metes, 1993). In the course of its development, **BESTNET** has been able to enhance various features of networked learning.

There are numerous publications, monographs, articles, corporate technical reports, manuals, and books in several languages throughout the world which describe how "**BESTNET**ers" have continually experimented with the art of teaching and learning while they are geographically separated from one another. These publications have shown that distance and distributed computer mediated technology greatly augments regular classroom instruction as well as distance for off-campus and distributed education. It provides individualized attention to student needs and requirements that can not be obtained using traditional methods of teaching. It supports a Socratic method of instruction, whereby students are much more actively involved in the learning process rather than being passive recipients, and the anonymity of the technology promotes discussion that otherwise would be inhibited (Arias & Bellman, 1993; Truxal, 1991).

In the **BESTNET** virtual learning environment, computer mediated communications promote global student-to-student interaction and collaborative work. Computer naive students learn with equal facility more sophisticated technology. As a consequence of having this experience and familiarity with new technologies, many students who traditionally are not recruited into the science and mathematics fields have switched their majors.

BESTNET has a large experienced globally assembled faculty, expert technical staff, and highly engaged students that concurrently designs improvements in the network in concert with the courses and learning experiences being offered and continually under development. In the process of this development a number of faculty, students and expert technical personnel express a strong interest in designing a fully integrated multimedia network, especially in science, engineering, humanities, computer sciences, teledramatic arts and technology, as well as the social and behavioral sciences. We are now experimenting in such a manner so as to reach far beyond the original project (as described above) and design a multimedia network over the Internet that can be generally accessed. Our educational goal is that on line global learners will not simply take art, humanities, science, or education courses; learners will be actively involved in the design and implementation of these areas, experiencing them as "on line learners of virtual practice" as well as traditional and developing theory, to achieve this educational goal, the **BESTNET** educational structure is multidisciplinary and based in a global virtual community of scholars. Hence, the residential programs of participating member institutions are an integral part of the virtual educational program; especially as virtual courses are team-taught between entirely different institutions or systems. Again, the purpose of **BESTNET** is that on-line global learners will be self-reliant, directly involved in active virtual learning, reflecting consciously on what they are doing, and learning the skill of on line collaboration throughout life. As shown in all of **BESTNET**'s virtual educational activities, the purpose is not simply to teach about, but to employ the best (most technologically and pedagogically sound) practices of learning and teaching in a continuously developing virtual scholarly environment.

The computer supported collaborative work (CSCW) component of **BESTNET** is experimenting with recently developed software to permit both real time and asynchronous use of white board and modeling tools over **BESTNET** (as it operates as a "privatized" scholar's network, encapsulated, while traveling through the Internet). "**BESTNET**ers" are working closely with METIS systems and ASK Computer Groups as our corporate partners in developing these technological capabilities. **BESTNET**, METIS and ASK have and are currently designing software as a global model engine with capabilities to build, introduce and use active-models employing a variety of symbolic languages specific to the range of scientific disciplines. Again, we are also experimenting with white boards developed by Digital Equipment Corporation and Hewlett Packard, which permit multi-user manipulation of networked terminals and uses combinations of voice, video and text files. We are also working, as a collaborative corporate partner in this project, with MCI to fully develop and expand the ability of each multimedia technology to be delivered globally, over the Internet and, in the case of real time compressed video, in adjacent channels.

Growing Need for Multimedia Computer Global Network Communications

BESTNET scholars and students have been quite successful at utilizing computer conferencing as a text based system. We understand that it is limited in terms of graphics, visual and aural augmentation to basic lecture and text materials. However, students learn through multisensory, multidimensional learning experiences, especially in the sciences where laboratory work is crucial to learning (McLellan, 1993). The ability to communicate visually and orally with students engaging one another in a global virtual environment, greatly enhances the classroom teacher's capabilities. Advances in using video and audio computer files to augmented interact with text in multimedia mail have been successfully used by **BESTNET** faculty and corporate trainers (David & Moore, 1992). Although these advances are significant, there is currently no multimedia computer mediated conferencing capability whereby global servers can be accessed for shared multi-media files, and structured multi-media data bases. The availability of recent advances in compressed video using ISDN lines provides new opportunities for real time desk-top video conferencing, which we will juxtapose as an adjacent technology to the Internet multimedia communications.

The sharing of multimedia work and modeling tools have become integral across disciplines. The development, introduction and use of computer supported active models is a paradigm shift in human teaching, learning and assessment in computer supported collaborative work. The use of such models has greatly impacted both the global engineering and scientific communities, and are critical to understand complex systems across disciplines (Hammer,1996). These vibrant models are object-oriented and value-set driven. Objects belong to many class hierarchies and participate in many concurrent processes. The multi-level, multi-dimensional, dynamic behavior of real-world objects has become an integral part of these disciplines, and consequently is a crucial component in most discipline curricula. The incorporation of such tools is essential to **BESTNET** as it continuously renews itself as a viable global networked learning environment.

Computer communications networks are rapidly extending to most areas of the world (Grenler & Metes, 1992). These involve a combination of networks ranging from public, academic, governmental and military data packet switching systems to FIDO store and forward micro based networks. Scientists and other scholars, both within and outside of academia, internationally communicate with colleagues to both network with each other and to conduct computer communications supported collaborative work or as we say in **BESTNET** they "work together while they are apart". Such projects range from the sharing of information to actual coordination of research efforts establishing virtual laboratories. The use of electronic mail and computer mediated conferencing is an accepted delivery system for various academic programs in post-secondary and continuing education at universities in the United States, Canada, Latin America, Europe and Asia. Most recently there have been several networking projects advocated for Africa, Eastern Europe and Russia.

Opportunities for international and intercultural communication over these networks are rapidly expanding. It is estimated that thousands of new networks are being added to the Internet each day, and the number of Internet users is now in the millions. The only limitations to effective international and intercultural communication are human and not tech-

nological (Ringle, 1992). Many users are unable to read and write in other languages, and so are restricted in their ability to communicate across cultures. Others may have conversational skills in another language, but cannot effectively write in it. Often they participate in discussions by reading in the other language, and writing in their first language. However, these interactions are often stifled and restricted.

The choice of language is not only a technical consideration, but also a political act. For example, one of our collaborators or NEUROPELAB in Archamps, France, has for the past five years been conducting a major health related computer communications project called JITOL (Just in Time Open Learning). The project involves health researchers and physicians from several European countries conjointly researching and monitoring diabetes patients. The participants debated about which language to use in their on-line discussions. They finally decided on English because it was second language to all of them, and that consequently no one would have a language advantage over the other. Hence, English was selected as a political compromise.

Other participants in this experiment include faculty and their respective students who are conducting research into environmental and hazardous waste issues along the United States and Mexico border. Through **BESTNET** we established a distributed computer mediated conferencing network with several of these institutions on both sides of the border. Most of the discussions have been conducted in separate English and Spanish language computer conferences, requiring a few bilingual and biliterate participants to act as interpreter/translators. With the enactment of NAFTA (North American Free Trade Agreement) there is now a major emphasis on collaborative efforts to deal with environmental and health issues along the U.S.-Mexico border. Where previously many of the computer conferences were primarily instructional augments to courses in each university, there are now serious discussions about the need for effective communication (especially intercultural) in collaborative teaching, learning and research projects, and policy debates. (California State University co-sponsored a trinational conference focused on just this issue in November 1996.) It is vital that as many participants as possible develop reading and writing literacy skills if these on-line or computer communications cross/trans-border discussions are to be fully effective.

Related Developments with Translation Technologies

We are presently working on the development of infrastructural capabilities in the Internet to support global multilingual and intercultural communications. We are experimenting with mechanisms for translating and distributing text files and electronic messages specific to science and mathematical disciplines in English, Spanish and French sent over the Internet. In addition to providing an infrastructure for text based translations, we are also experimenting with database development relevant to cultural analysis to assist in resolving intercultural misunderstandings due to different culture based assumptions and connotated meanings attributed to different terms.

Our work involves the collaboration of faculty, students and staff from several international universities, research institutes and private sector corporations who share a concern that effective intercultural communications within and between disciplines necessitates the development of a translation and cultural interpretation capacity over the Internet. Participating academic institutions include California State Universities at Monterey Bay, Los Angeles, San Diego, and, Dominguez Hills, the University of California at Irvine and Texas A&M University in the United States, and the Instituto Tecnologico in Tijuana (ITT), Instituto Tecnologico in Mexicali (ITM), the Colegio de la Frontera Norte (COLEF) in Tijuana and the Centro de Ensenansa Tecnica y Superior in Tijuana, Baja California. In addition, the RAND Corporation is participating through two of its Centers, the Institute for Education and Training, and the Center for Information Revolution Study. In Europe Neuropelab, an education research organization, is assisting in the development of French language translation and will involve participating European universities in the project, including the University of Geneva and the University of Paris. Our corporate partners in this project include ED&D a division of AT&T Global Systems, MCI Communications, NCR and METIS/International.

BESTNET researchers are planning to bring translation and cultural interpretation infrastructure to the Internet that is targeted to the science and math disciplines. This innovation will greatly assist university recruitment of non-traditional and language minority students into these fields. For example, in

the United States minorities are gravely under-represented in the science fields, and women seldom enter into the fields requiring mathematical practice. On the other hand, in Mexico women are strongly represented in technological and science disciplines. At the Instituto Technological in both Tijuana and Mexicali, our research demonstrates that women comprise over 50% of students in the engineering disciplines (Arias, 1992). **BESTNET** students in Mexico and other international sites, are interacting with students at United States universities and secondary schools in a number of collaboratively taught science and math courses. We have found that this provides both student and faculty role models for United States under-represented students (Arias & Bellman, 1990).

The development of these technologies for non-classroom based instruction is a growing critical concern of most university systems as they restructure themselves for growth in the context of declining resources (Ringle, 1992). The ability to have multilingual and intercultural educational programs on the Internet will permit the cooperative sharing of courses, on a global basis; hence, across campuses, whereby a particular course can be taught on one campus and delivered throughout a university system. Likewise, it will permit collaborative instruction between faculty at different international institutions, permitting students to have access to specialization's and expertise that otherwise would not be directly available to them.

Project **BESTNET** involves the mutual participation of universities and technical institutes in the United States, Mexico, France and Switzerland working in collaboration with private sector communications and software corporations. Several pilot courses using multimedia collaborative technologies are being developed in the mathematical, biological, natural, social and health sciences between international institutions. Our objective is to identify and meet the specific translation, cultural, pedagogical and communication requirements of different science disciplines for networked delivery of different types of courses and on-line laboratory-research work. We are experimenting with developing, tailoring and utilizing these technologies in concert with private sector collaboration and support.

The need for collaborative intercultural scientific research and intercultural collaborative educational programs requires not only effective translation of computer text files and messages, but also their interpretation according to culturally relevant interaction practices and discipline specific terminologies. Intercultural differences also exist at higher order levels, including policy interpretations, risk assessment and priorities. Consequently, viable translation must operate at several simultaneous levels; terminological, syntactic, semantic and systemic.

In the next phase of **BESTNET** we will teach languages using computer mediated conferences in each language that initially will have restricted vocabularies, and over the course of a specified period of time add additional vocabulary in concert with the development of language expertise skills of the participants. We are experimenting with the development of an on-line editor for computer conferences that permits only terms that are in the restricted vocabulary, and that permits new items to be included by the system administrator.

The selection of initial vocabulary is made based on the interests and academic discipline interests of conference participants. We are conducting research to locate primary vocabulary for three different discipline areas: **(1)** mathematics, physics, and engineering (for computer conferences in environmental issues and hazardous waste disposal), **(2)** biological and health sciences (for computer conferences in international public health and primary health care) and **(3)** social sciences and humanities (for computer conferences in intercultural communications, border art and literature).

We are experimenting with the design of an on-line editor. Hence, we must work closely with international colleagues in each of our project disciplines to define the appropriate vocabulary items to use, and develop an on-line dictionary for participants to access. We have begun with pilot computer conferences in each of the above areas and test the viability of the initial vocabulary selections using faculty and student in **BESTNET**. After revising the respective vocabularies we require our students to take the computer conferences. We then create separate groups of participants to compare the effects of our program on participants who are monolingual and monoliterate with those who are bilingual but monoliterate.

Although there are numerous commercially available translation software packages for personal computers, their applications are very restricted and require that users have bilingual facility to deal with the ambiguities of translations. In addition, these software are not sensitive to the specific communication requirements of the different scientific disciplines, and the culturally relevant rules of language use and the metacommunicative features of intercultural social interaction.

Adaptive Infrastructure

In order to build a translation infrastructure for the Internet we will develop a network capacity for routing messages and text files to globally located servers that contain translation software for specific languages. Different servers (located in different countries) are being dedicated for translation into and others from each of the target languages in **BESTNET**. This enables us to develop sub-dictionaries for translations, syntactic rules, and cultural interpretations relevant to translation requirements in each direction.

In order to derive the translation databases relevant to each discipline and language group, we are teaching courses in different science and math disciplines using computer mediated communications between groups of students in United States, Mexican, French and Swiss universities. Faculty at each institution teach on-line classes to colleagues courses at foreign universities, and act as faculty of record for the students at their own institutions. Each of the courses will be taught using computer conferences, electronic mail and transferred text files. The courses are offered at **BESTNET** member institutions, as well as at off campus locations such as participating community colleges and high schools in culturally diverse and under-served areas.

Along with these on-line courses several of our colleagues are conducting international computer mediated conferences dealing with substantive areas of their research, with a focus on environmental and hazardous waste issues. This research entails each of the scientific disciplines we are dealing with, and also concerns major economic, social and policy interpretations across cultures. Consequently, on line international computer conferences discussions, messages and transferred graphic and text files in this substantive area will enable us to develop cultural interpretation databases relevant to the different scientific disciplines.

These files will be translated and will be entered into the micro-dictionary databases in the translation programs we utilize. We will also use METIS software to arrange translation and cultural rules and map the complex interpretation systems with which we are dealing. The use of METIS and similar modeling tools have greatly impacted both the engineering and scientific communities, and are critical to understand complex systems. These models are object-oriented and value-set driven. Objects belong to many class hierarchies and participate in many concurrent processes. The multi-level, multi-dimensional, dynamic behavior of real-world objects is an integral part of the translation and interpretation process. METIS will provide both software and engineering support to fully develop this capacity of our translation and cultural interpretation engine.

After developing the first phase conferences in English and Spanish, we will add French language conferences with colleagues at NEUROPELAB and their associated universities in Geneva and Paris. We will work with NERUOPELAB to conduct research into diabetes and other chronic illnesses with colleagues in the United States and Mexico by supporting computer conferences in French, English and Spanish. We will monitor participants from each of the respective languages as to their development of skills in the other two languages, and again consider differences between monolingual and monoliterate, bilingual and monoliterate, as well as those who have capacity with speaking or reading two of the three languages. **BESTNET** has as its objective to provide a method for teaching languages using on-line computer mediated communications that can later be applied to other languages. Concomitantly, it supports the needs of faculty and students who have an immediate interest in effective global and intercultural communication.

Conclusion

The concepts of a "global virtual university system" and "viable global networked learning" are taking hold throughout the world. The **BESTNET** paradigm for looking at improving education has proven to be one of the most advanced. It is built-upon three critical foundations: **(1)** a variety of useful, applicable technologies; **(2)** the experience and dedication of faculty and institutions who experience, promote and share the common goal of broadening knowledge; and **(3)** a sixth sense that the world will be globally connected, linked across borders, frontiers, languages and academic scholarship. Although these are the most critical technological ingredients for the future success of global networked learning, we are especially concerned with the impact technological innovations have on the everyday interactions of educators, as they go about the business of educating for a better life.

BESTNETers are advancing numerous initiatives for the implementation of the renewal or "brandnewal" process at our member institutions. These include (but are certainly not limited to) our rethinking of institutional research and assessment, non-traditional approaches to renewal and accreditation, and shared leadership and faculty governance structures that extend beyond the traditional concepts of faculty roles and rewards.

By the year 2000, we aspire to have partnered in the founding of the Inter-American College, located in National City, Calif. We have a goal of achieving candidacy status with the Western Association of Schools and Colleges (WASC). We seek recognition as a fully accredited virtual learning university for purposeful renewal/"brandnewal" of education. We presently seek the later recognition not only because it will validate our work and our learners' products, but also because it will establish our "ways" of doing business as effective, reliable, and worthy of emulation. Too many successful technological innovations in American higher education have never validated through quality standards of evaluation or accreditation. We seek the path that promotes education and learning through shared, virtual experiences with **BESTNET**.

American higher education is going through a soul-searching process to position itself for the next century — this occurs at a time when there is need for major reforms. **BESTNET** continues to develop in a context by which member institutions desire and are planning to change themselves. Even with all the "technological breakthroughs," it could be said that **BESTNET** is just at the frontier of creating a new culture; a "culture of innovation" which serves as a conceptual overlay, which implicitly infuses an experimental intent into its design for education. This theme of innovation is reflected in how we envision a virtual global learning environment which is "essentially collaborative in its orientation." Nonetheless, I believe that **BESTNET** is by many standards an outstanding example of current "renewal" efforts. Our innovations in the utilization of shared technology and their impact on learning and teaching, research, and work are demonstrating to our colleagues in the Academy, how a virtual university can yield improved educational outcomes within the financial resources of our member institutions. If anything is proof positive, **BESTNET** is developing an identity where it's "O.K." to do things differently — most especially as we are wholeheartedly committed to technological renewal.

If interested in more information and details, please contact me at my campus address: California State University, Monterey Bay. Or use the e-mail: <armando_arias@internet.monterey.edu>.

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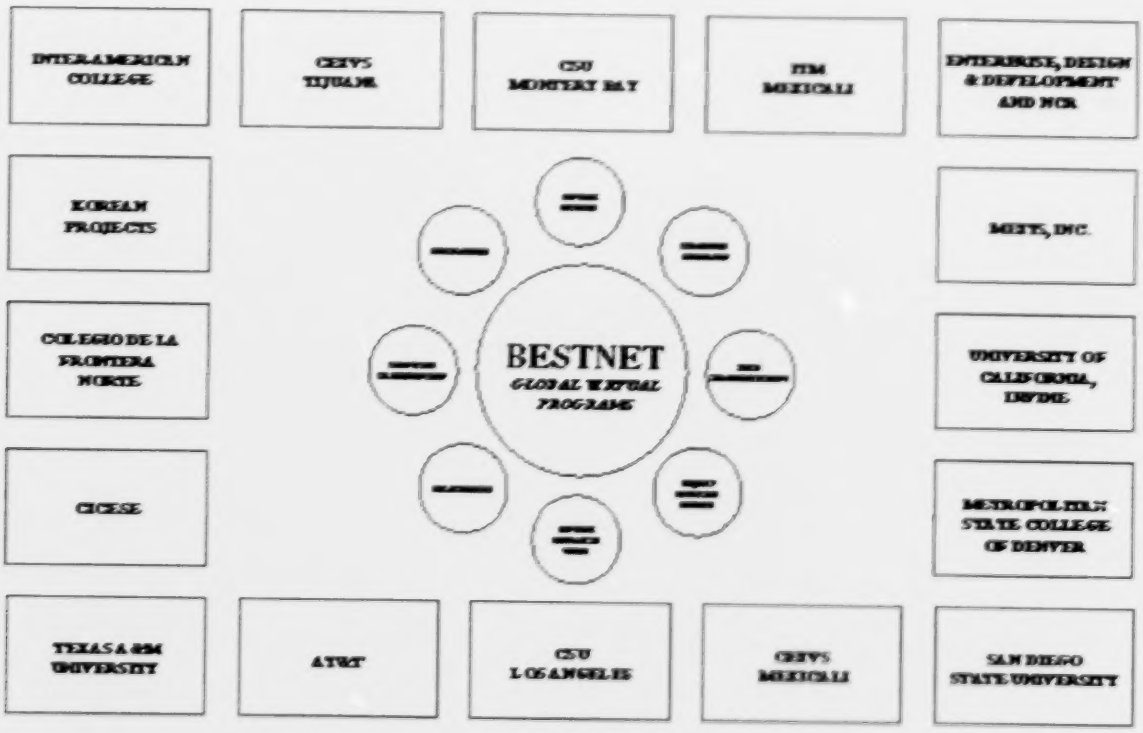

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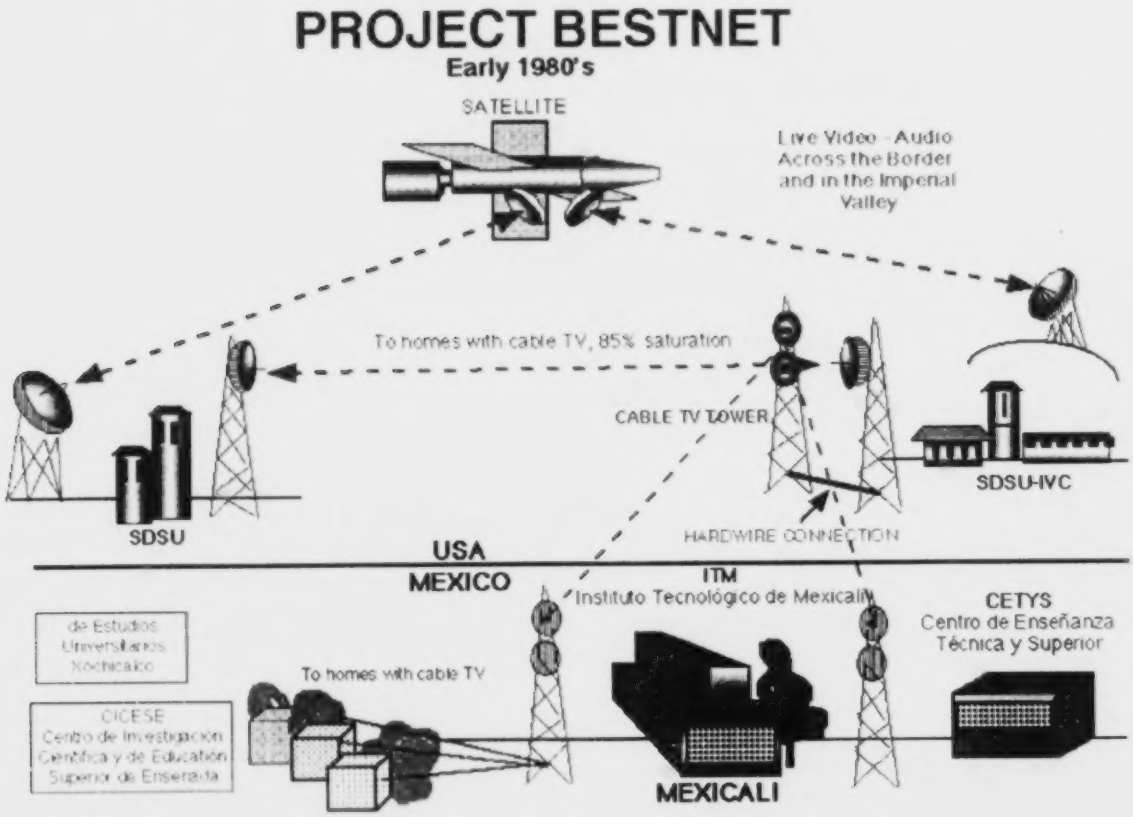

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